Presentation to NASA Advisory Council

Joint Science and Human Exploration and Operations Committees

23 July 2012

MPPG

Mars Program Planning Group

Topics

Mars Program Re-Planning 2012

1. Context
2. Science/Science Implementation
3. LPI Workshop
4. Synergy with Human Exploration
5. Opportunity for Technology Infusion
6. Public Engagement
7. Summary

The Charter to MPPG

Mars Program Re-Planning 2012

- MPPG is delivering options for NASA's consideration, on a new architecture (sequence of interconnected missions), with particular attention to the 2018/2020 opportunities that follow MSL/Curiosity, MAVEN, and ESA/TGO missions

- Options reflect
  - Science driven approach, guided by the primary objectives of the NRC Decadal Survey
  - A closer, strategic collaboration between SMD, HEO, OCT, and OCS
  - Education and Public Engagement opportunities

- Collaboration with HEO also reflects responsiveness to the President's challenge of human travel to Mars orbit in the decade of the 2030s

Structuring a Mars Program

Mars Program Re-Planning 2012

- The Mars Exploration Program (MEP) of record has been extraordinarily successful. It validates the wisdom of planning a strategic program as opposed to a collection of disconnected missions. In a properly structured program:
  - Missions are coupled scientifically, technologically, and operationally
  - They follow an overarching scientific theme:
    - e.g., understand the habitability of Mars – past or present
  - They follow an overall Program strategy:
    - e.g., "follow the water", or "search for organics"
- A science driven program moving forward must also:
  - Anticipate enabling technological needs and maintain a robust technology development program
  - Create opportunities that fill in strategic knowledge gaps as identified by the human space flight program needs, goals, and objectives
  - Maintain an integrated, robust education and public engagement component

NRC Recommendations

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- NRC *Decadal Survey* science recommendation for Mars Exploration is **Sample Return** on the basis of**:**
  - Best support to the search for evidence of ancient life questions
  - Broad Community support, and a consistent priority for decades

- Mars Sample Return (MSR) as an end-to-end endeavor is complex. Concepts assessed by the NRC carried a large price tag. To ensure the required budget profile does not peak too highly in any one year, the overall mission has been broken into a number of discrete elements launched in different opportunities
  - Hence an MSR "campaign" which spans nearly a decade to keep yearly budgets manageable
- While this approach keeps annual budget in check, it required a decade long commitment to deliver all of the MSR elements

- Therefore, MPPG embarked on evaluation and assessment of:
  1. Alternatives to MSR as a Mars program emphasis
  2. Alternative (lower cost) MSR implementation approaches

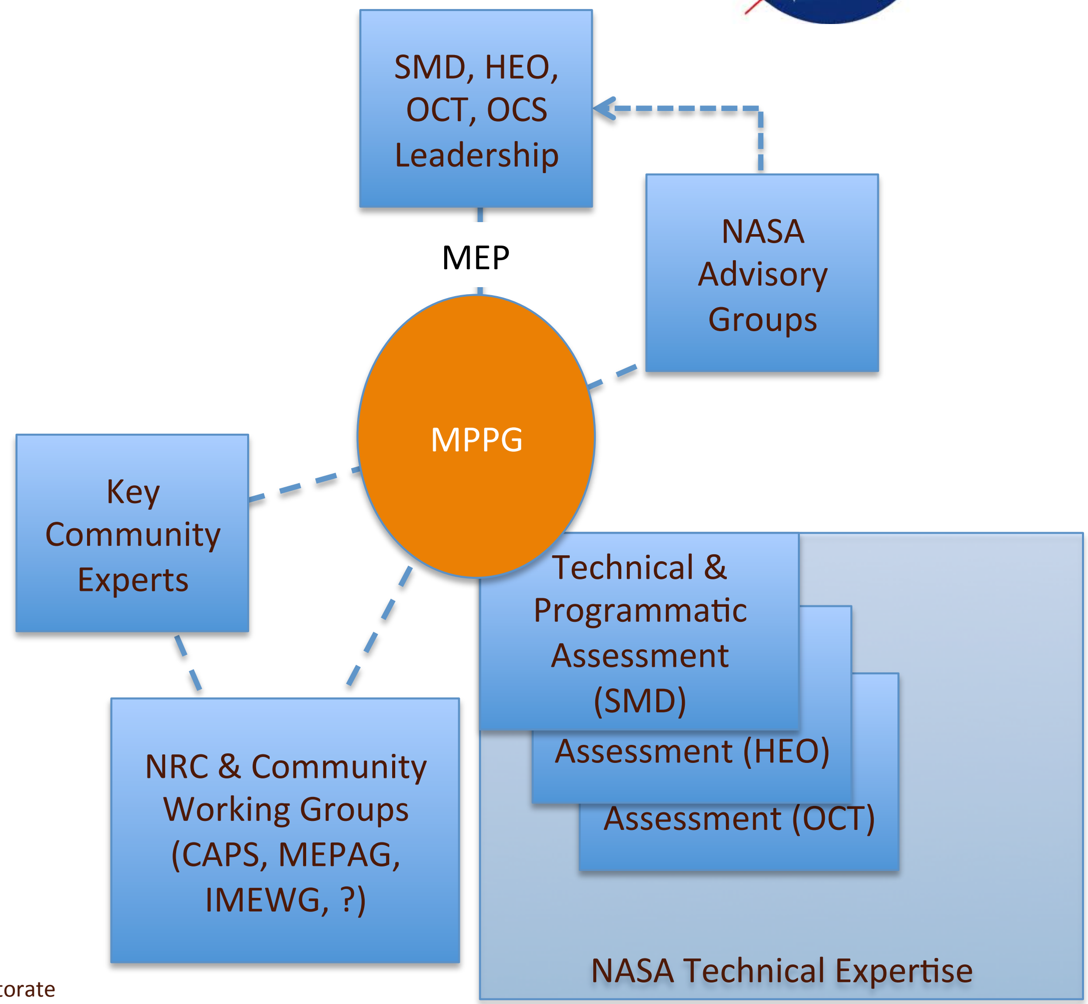
MPPG Core Team & Approach

Mars Program Re-Planning 2012

- O. Figueroa (Chair)
- J. Garvin (SMD/GSFC)
- M. Gates (HEOMD)
- M. Gazarik (OCT)
- D. McCleese (JPL)
- J. Mustard (Brown Univ.)
- F. Naderi (JPL)
- L. Pratt (Indiana Univ.)
- J. Shannon (HEOMD)
- G. Tahu (Exec Officer, HQ)

Ex-Officio

- R. DePaula (SMD/Intl Liaison)
- M. Wargo (HEOMD/Science)



GSFC = Goddard Space Flight Center
HEOMD = Human Exploration and Operations Mission Directorate
JPL = Jet Propulsion Laboratory
OCS = Office of Chief Scientist
OCT = Office of Chief Technologist
SMD = Science Mission Directorate

CAPS = NRC Committee on Astrobiology and Planetary Science
MEPAG = Mars Exploration Program Analysis Group
IMEWG = International Mars Exploration Working Group

Objectives/Constraints

Mars Program Re-Planning 2012

- MPPG developed figures of merit to guide the mission and architecture (including 2018/2020) options within the programmatic constraints
  - Advance the overarching scientific goals/objectives as stated in the NRC Decadal and MEPAG
  - Advance knowledge and capabilities required to enable eventual human exploration
  - Infuse/feed forward technology and capability
  - Provide opportunities for robotic and human spaceflight program interconnections
  - Be cost credible and within an acceptable risk posture
  - Provide opportunities for participation by industry and international communities
  - Other considerations (infrastructure, program cadence, preservation of technical competencies, etc.)
- The President's FY13 MEP budget narrows the trade space for what can be afforded in 2018
  - Current Rover options not credible for 2018 within budget constraints
  - A 2018 orbiter meets the above programmatic constraints and is consistent with the available budget – with some re-profile adjustments
  - Risk to the 2018 opportunity rises fast as end of the calendar year approaches

Pathways

Mars Program Re-Planning 2012

- Implementation strategies for Sample Return:
  - **Pathway- A**:
    - Commence MSR using existing data
    - Implemented at a pace that is consistent with available resources
  - **Pathway- B**:
    - Undertake multi-site investigation to optimize search for ancient life employing surface and orbital investigations to optimize the selection of samples to be returned to Earth
  - **Pathway- C**:
    - Credible approaches to sample return that trade science for lower costs

- Are there viable architectures that do not include MSR, within the budget constraints?

- MPPG used a concept similar (in approach) to the science pathways for the elaboration of human exploration pathways
  - Risk driven *(vs. science)* approach to achieve the goal of "humans in the Mars System" by 2033 in the safest and most efficient manner

Mars Concepts & Approaches Workshop

Hosted by Lunar & Planetary Institute (LPI), June 12-14, 2012

WHAT

- Workshop forum organized by Lunar and Planetary Institute (LPI) for the community to discuss ideas and approaches for Mars exploration
- Included both near-term (2018-2024) and longer-term (2024-2030s) timeframes
- Targeted to professional community, but open to all; entire workshop broadcast via Livestream
- LPI summary report submitted to NASA: June 18 (available for download at LPI website noted below)

Participation Statistics (to-date)	
Abstracts Submitted:	390
Abstracts Selected for Presentation:	170
Abstracts Selected for Print Only:	146
Abstracts Rejected:	74
Student Presenters:	>10
Livestream Viewers:	4,976
Unique IP address visitors	32,716

RESULTS

- Reinvigorated discussion/collaboration among communities of practice across science, engineering, technology, SMD, and HEOMD
- Examples of innovative concepts include:
  - Solar electric propulsion orbiters
  - Mini-Mars Ascent Vehicle (Mini-MAV) with nano-propulsion return vehicle
  - Mars Exploration Rover (MER)-based rover concepts
  - Miniaturized organics detection instruments
  - Precision sub-sampling for in-situ analysis
  - Concepts to access extreme terrain

http://www.lpi.usra.edu/meetings/marsconcepts2012/

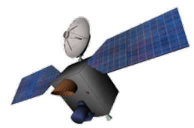
LPI Workshop (con't)

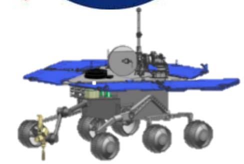
- The LPI workshop was of most benefit to MPPG in that it provided creative/ catalytic ideas for:
  - Lower cost mission concepts (e.g., MER class rovers, ascent and return spacecraft vehicles), ideas for access to extreme terrains
  - Synergistic technologies between SMD/HEO/OCT, leading to possible joint technology development opportunities (e.g., Solar Electric Propulsion, EDL, MAV, ISRU)
  - Reinforced need for continued record of key environmental measurements, inventory of resources availability, and approaches for investigating modern environments for habitability.
  - Student Experiments that can be manifested on smallsats/cubesats

- **MPPG used the results to:**
  - Charter sub-teams to explore *out of the box* ideas to enable cost effective approaches to Sample Return, now known *as **Pathway C*** (e.g. mini MAV with nano thrusters)
  - Further explore platforms for access to extreme terrains and their scientific interrogation, particularly those for surficial flows
  - Further explore technology collaboration opportunities

Current Focus of Study for Early Mission Options

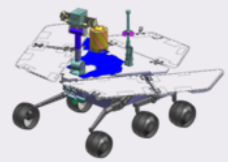
Mars Program Re-Planning 2012





	ORBITERS	**ROVERS**
Mission	Science & communications infrastructure	In-situ science & caching of select samples (3 concepts from Mars Exploration Rover- to Mars Science Laboratory-derived)
Instruments **(Competed or Contributed)**	Core: high resolution imaging, mineral spectroscopy Augmented: synthetic aperture radar, trace gas measurement	Core: Imaging & infrared spectroscopy, context & composition (sub millimeter scale) Augmented: miniature organics detection
Technology **(Synergistic with HEO)**	Optical comm, atomic clock, solar-electric propulsion, aerocapture	Precision landing (inflatable decelerators, smart parachutes, guided entry), atomic clock, DSN direct-to-Earth link, next generation UHF
HEO Strategic Knowledge Gaps	Radiation, climate/atmospheric measurements	TBD (radiation, atmospheric, cached sample) depending on rover design

Rover Concept Features Summary

	MER (end member)	Rover A (MER, airbags)	Rover B (MER+, airbags)	Rover C (MSL-, sky crane)	MSL (end member)
					
Payload Type	In-situ science	In-situ science and sampling/caching	In-situ science and sampling/caching	In-situ science and sampling/caching	In-situ science + sampling/analysis
Payload Mass	20 kg	**40-45 kg**	**55 kg**	**67 kg**	220 kg
Rover Mass (total w/ payload)	175 kg	**200 kg**	**280 kg**	**700 kg**	900 kg
Aeroshell Diameter	2.6 m	2.6 m Backshell **3.2 m Heatshield**	**3.2 m (new)**	4.5 m	4.5 m
Entry - Landing Ellipse	Ballistic - ~100 km	**Guided - ~10 km RCS in Heatshield**	**Guided - ~10 km RCS in Backshell**	Guided - ~10 km MSL	Guided - ~10 km
Descent & Landing	Airbag - 540 kg	Airbag - 540 kg	**Airbag - 800 kg**	Skycrane – Mobility	Skycrane - Mobility
Avionics	Rad600 VME	**MSL FPGA/ckt level, or New**	**MSL ~board-level New motor control**	MSL	RAD750, cPCI
Rover Mobility	MER	MER	**Scaled MER**	MSL	MSL
Rover Power/Thermal	Solar – Rigid + RHU	Solar – Rigid + RHU	Solar – Rigid + RHU	**Solar –Ultraflex + RHU**	RTG + Pumped fluid loop
Rover Design Latitude	10N/15S	**15S/30N**	**15S/30N**	**15S/30N**	+/- 30 degrees
Rover Design Lifetime	90 sols (*DESIGN*)	**360 sols 1-2 km traverse**	**360 sols TBD km traverse**	**360 sols+ 20 km traverse**	687 sols (*DESIGN*)
Launch Vehicle	Delta 7925/ Delta 7925H	**Falcon 9** or Atlas V - 401	**Falcon 9** or Atlas V - 401	Atlas 5 – 531 / 541	Atlas 5 - 541

Pathway C – Sample Trade Space

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<u>Orbiter Configurations</u>

Orb 1.0 Small dedicated rendezvous & return system (Neo-Surveyor Class)

Orb 2.0 Infrastructure (MRO Class) with staged or full-s/c rendezvous & return capability

<u>Surface Delivery Configurations</u>

Del 1.0 MER/MPF airbags

Del 2.0 MSL Sky Crane

Del 3.0 Phoenix propulsive

Del 4.0 MSL w/ 100m(?) landing accuracy

<u>Surface System Configurations</u>

Local site, short range

Surf 1.1 Airbag Lander + Drill+ MAV

Surf 1.2 Sky Crane Pallet + Drill+ MAV

Surf 1.3 Sky Crane pallet + Rover (1.0) + MAV

Moderate range

Surf 2.1 Sky Crane Pallet + MAV + Rover (2.0)

Long range

Surf 3.1 Sky Crane Mobile Rover (3.0) + MAV

<u>MAV Configurations</u>

MAV 1.0 Mini-MAV (100 kg class)

MAV 2.0 Mod-MAV (200 kg class, 500 km circular)

MAV 3.0 Full-MAV (300 kg class)

MAV 4.0 MAV with nano-SEP return vehicle

<u>Rover Configurations</u>

Rov 1.0 Small size/range, <200 kg

Rov 2.0 Moderate size/range, <500 kg

Rov 3.0 Large size/range, <1000 kg

<u>Launch Configurations</u>

Two Separate

Co-Manifested

Numerous Launch Vehicles

Synergies with Human Exploration

Mars Program Re-Planning 2012

- It first appeared that the President's challenge of sending humans to the Mars system in the 2030s would provide a convenient intersection for the robotic and human space programs.
  - MPPG began with the assumption that Mars samples placed in Mars orbit by a robotic mission could be collected and returned to Earth by humans, with robotic return as backup
  - Programmatic implications and cost of the various architectures were not considered as part of the MPPG action
- MPPG conducted architectural trade studies of humans to the Mars system using risk as a differentiator
  - Assembled MPPG/HEOMD team at JSC with multi-Center participation, equivalent to the JPL Advanced Studies & Program Architecture team for robotic missions, and appointed a human/robotic mission lead at JPL
  - Focused the Precursor Strategic Analysis Group on Strategic Knowledge Gaps
  - Analyzed, prioritized, and integrated information from multiple sources (Mars Design Reference Architecture 5.0 and previous studies, current human architecture assessments, Strategic Knowledge Gaps), performed technical and schedule risks assessment of the architecture system elements

Human Exploration Roadmap

Mars Program Re-Planning 2012

- Preliminary analysis suggests that there are increased risks to the crew in orbit-only mission (galactic cosmic radiation, behavioral health, etc). If we did envision an orbit-only mission, the analysis recommend landed missions beginning 1-2 opportunities later to preserve capability.

- Understanding the risks to the crew of landing, living (1/3 g adaptation, radiation, etc.), and then ascending from Mars orbit, require additional investigation and systems development.

- Robotic missions play an important role in reducing human mission risk, for example:
  - Mars Science Laboratory mission carries instrumentation for measurements during entry, descent, and landing and a radiation instrument on Curiosity. MSL will provide the largest EDL data set ever for performance in non-Earth entry

Human and Science Shared Benefits

- Human Mars exploration strategic roadmapping, including results of the PSAG chartered by NASA, yielded an overall assessment that there are useful measurements, needed technology demos, and opportunities for missions of joint benefit.

- Human exploration and science share benefits in:
  - Aerocapture
  - Automated rendezvous and docking
  - EDL technologies/techniques particularly those with promise of scalability
  - In-situ propellant production (oxygen from the atmosphere)
  - Mars ascent propulsion demonstration (oxygen based)
  - Mars environmental and atmospheric data

- Mars Sample Return is a promising area for innovative ideas and increased collaboration

- MPPG work is also including the potential of sending Martian samples robotically to the Earth-Moon system to be retrieved and returned to Earth by astronauts.

Precursor Strategic Analysis Group (P-SAG)

Mars Program Re-Planning 2012

- NASA HQ chartered P-SAG as a special analysis group of MEPAG and Small Bodies Analysis Group (SBAG)
  - Driven by the need to understand pre-human access knowledge to enable human exploration (both from orbit and to the surface)
  - Report available at http://mepag.nasa.gov/reports/psag.html

- P-SAG offered several recommendations for scientific measurement priorities showing a clear intersection of science and human exploration needs, and including the recommended vantage point to address them; among those recommendations (also reinforced at the LPI Workshop) are:
  - <u>Mars climate conditions</u> for understanding the atmospheric dynamics and increasing capability of landing
  - <u>Surface Radiation Environment</u> for determining the best shielding approaches and operational scenarios
  - <u>Direct characterization and quantitative analysis of returned Mars samples</u> in Earth laboratories for human safety related measurements - consistent with NRC “Safe On Mars” report [NRC “Safe on Mars”, 2002]

Precursor Strategic Analysis Group

Mars Program Re-Planning 2012

Relationship of Strategic Knowledge Gaps to Science

Scientific Objectives, Martian System | **SKGs**

Objective		#	Investigation (from 2010 MEPAG Goals Document)	A1 Upper Atmosphere	A2 Atm. Modeling	A3 Orbital Particulates	A4 Technology: To/from Mars System	B1 Lower Atmosphere	B2 Back PP	B3 Crew Health and Performance	B4 Dust Effects	B5 Forward PP	B6 Atmospheric ISRU	B7 Landing Site and Surface Hazards	B8 Technology: Mars Surface	C1 Phobos/Deimos Science	C2 Phobos/Deimos surface Ops	C3 Technology: Phobo/Deimos	D1 Water Resources	D2 Technology: Sustained Presence
I. Life	A. Past habitability/life	1	PRIOR HABITABILITY OF SURFACE ENVIRONMENTS				Not addressed.								Not addressed.			Not addressed.	S	Not addressed.
		2	PRESERVATION POTENTIAL																	
		3	EVIDENCE OF PRIOR HABITABILITY OR BIOSIGNATURES																	
	B. Present habitability/life	1	PRESENTLY HABITABLE ENVIRONMENTS						E			E							S	
		2	DEGRADATION OF LIFE SIGNATURES						S			E								
		3	SEARCH FOR EXTANT LIFE						E			S								
	C. Evolution of habitability	1	CHARACTERIZE HYDROLOGICAL CYCLE																S	
		2	BIOESSENTIAL ELEMENTS																	
		3	POTENTIAL ENERGY SOURCES																	
		4	OXIDATIVE / RADIATION HAZARDS						E	E	S			S						
II. Climate	A. Present	1	WATER, CO2, AND DUST PROCESSES	E	E			E		S	S		E	S					S	
		2	PHOTOCHEMICAL SPECIES	S	S			S	E		S		E							
		3	VOLATILE AND DUST EXCHANGE	S	S			S			S		E							
		4	SEARCH FOR MICROCLIMATES						S		S	S	S							
	B. Recent	1	ISOTOPIC, NOBLE, & TRACE GAS CHANGES W/ OBLIQUITY																	
		2	STRATIGRAPHIC RECORD--PLD																	
		3	PERIGLACIAL PROCESSES																	
	C. Ancient	1	RATES OF ESCAPE OF KEY SPECIES																	
		2	PHYS AND CHEM RECORDS																S	
		3	ISOTOPIC, NOBLE, AND TRACE GAS EVOLUTION																	
III. Geology/ Geophysics	A. Crust	1	MINERALOGY OF GEOLOGIC UNITS							S	E			E					E	
		2	SEDIMENTARY PROCESSES AND EVOLUTION							S	S			S					S	
		3	ABSOLUTE AGES																	
		4	HYDROTHERMAL ENVIRONMENTS						E										S	
		5	IGNEOUS PROCESSES AND EVOLUTION																	
		6	SURFACE-ATM INTERACTIONS								S			S					S	
		7	TECTONIC HISTORY OF CRUST																	
		8	PRESENT STATE AND CYCLING OF WATER																E	
		9	CRUSTAL MAGNETIZATION																	
		10	EFFECTS OF IMPACTS																	
	B. Interior	1	STRUCTURE AND DYNAMICS OF INTERIOR																	
		2	ORIGIN AND HISTORY OF MAGNETIC FIELD																	
		3	CHEMICAL AND THERMAL EVOLUTION																	
	C. Phobos / Deimos	1	ORIGIN													E	S			
		2	COMPOSITION													E	E			
		3	INTERNAL STRUCTURE													E	E			

NO OVERLAP | EXCELLENT OVERLAP | SOME OVERLAP

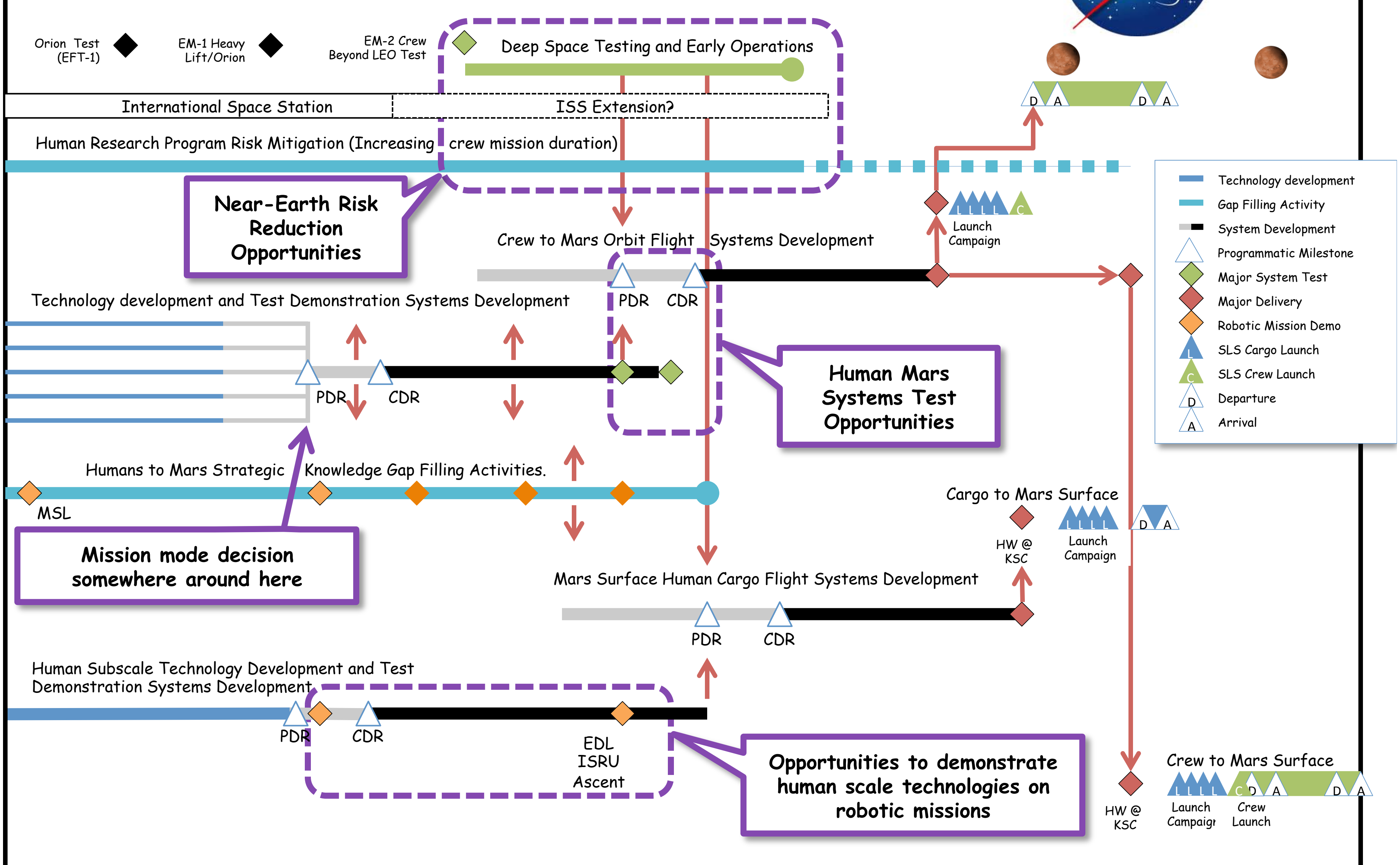
Gap-Filling Analysis Example

Mars Program Re-Planning 2012

SKG		Gap-Filling Activity	Priority	Timing	Location
A1	Upper Atmosphere	A1-1. Global temperature field.	H	IV-	Mars Orbit
		A1-2. Global aerosol profiles and properties	H	IV-	Mars Orbit
		A1-3. Global winds and wind profiles	M	IV-	Mars Orbit
A2	Atm. Modeling	A2-1. Atm. Modeling.	H	IV-	Earth
A3	Orbital Particulates	A3-1. Orbital particulate environment	M	IV-	Mars Orbit
A4	Technology: To/ from Mars System	A4-1. Autonomous rendezvous and docking demo	H	IV-	Earth or Mars Orbit
		A4-2. Optical Comm. Tech demo	H	IV-	Earth or Mars Orbit
		A4-3. Aerocapture demo	M	IV-	Earth or Mars Orbit
		A4-4. Auto systems tech demo	L	IV-	Earth
		A4-5. In space prop tech demo	H	IV-	Earth
		A4-6. Life support tech demo	H	IV-	Earth
		A4-7. Mechanisms tech demo	L	IV-	Earth
B1	Lower Atmosphere	B1-1. Dust Climatology	H	IV Late	Mars Orbit
		B1-2. Global surface pressure; local weather	H	IV Early	Mars surface
		B1-3. Surface winds	M	IV Early	Mars surface
		B1-4. EDL profiles	M	IV Early	Mars EDL
		B1-5. Atmospheric Electricity conditions	L	IV Late	Mars surface
		B1-6. EDL demo	H	IV Early	Mars EDL
		B1-7. Ascent demo	H	IV Early	Earth or Mars Surface
B2	Back Contamination	B2-1. Biohazards	H	IV Early	Sample return
B3	Crew Health & Performance	B3-1. Neutrons with directionality	M	IV Late	Mars surface
		B3-2. Simultaneous spectra of solar energetic particles in space and in the surface.	M	IV Late	Mars surface and Mars orbit
		B3-3. Spectra of galactic cosmic rays in space.	L	IV Late	NEAR EARTH
		B3-4. Spectra of galactic cosmic rays on surface.	M	IV Late	Mars surface
		B3-5. Toxicity of dust to crew	M	IV Late	Sample return
		B3-6. Radiation protection demo	H	IV Late	Earth or Mars Surface
B4	Dust Effects on Surface Systems	B4-1. Electricity	L	IV Late	Mars surface
		B4-2. Dust physical, chemical and electrical properties	H	IV Late	Mars Surface or Sample return
		B4-3. Regolith physical properties and structure	M	IV Late	Mars Surface or Sample return

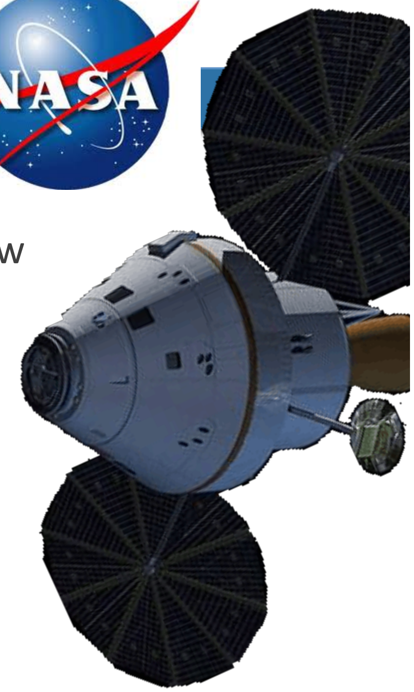
DRAFT – Human Exploration Roadmap: Intersections

Mars Program Re-Planning 2012



Mars Sample Return During Early Operations Beyond Earth Orbit

Mars Program Re-Planning 2012



- As an alternative to astronauts retrieving samples from Mars orbit, MPPG also studied using an SEP enabled vehicle delivering samples to Lunar orbit for a crew retrieval
- Crew sends robot ≈1km to capture, encase
  and retrieve the sample canister tele-robotically
  - Crew robotically inspects canister exterior and seals, encases canister
  - Robot brings sample back and does rendezvous with a crewed vehicle
  - Encased sample canister is brought through the airlock/hatch into a glove box for cleaning (e.g. hydrogen peroxide)
  - Cleaned sample canister is then enclosed in a stowage case, sealed and removed from the glove box and stowed in Orion for Earth return.
- This approach is feasible and provides an additional measure of safety and planetary protection at a safe distance from Earth, and mass savings from lack of robotic Earth re-entry vehicle from Mars.
  - Crew inspection, cleaning, and more enclosures prior to Earth return
  - Crew entry system is inherently more reliable for Earth entry
  - Provides opportunity for additional testing safely away from Earth
  - Saves mass and cost of Earth re-entry system for sample canister

Technology Development

Mars Program Re-Planning 2012

- Enabling technologies are a critical part of the Mars Exploration Program. Anticipating needs and targeting technology developments, as well as the pull from cross-cutting technology efforts is key. Close coordination between Directorates is encouraged, with Mars as the objective. Relevant technology areas of collaboration: technology areas related to EDL, Communication, MAV (including ISRU enabled).

- There are technologies within the control of the SMD/Mars Program that need targeted attention
  - Maturation of compact sample acquisition, retrieval, handling and storage systems (i.e., laboratory/field demonstrations on Earth), and in situ sample analysis and context instruments are key for in-situ science relevant to sample return (Mars Instrument Design & Development Program has not been funded in some time, and the Planetary Instrument Design & Development and Astrobiology Science and Technology Instrument Development programs have experienced low selection rates that may not allow robust development of required solutions to drive smaller and lower cost solutions.
  - Technologies (including supporting processes and approaches) that enable lower cost implementation approaches expected to be derived from the Pathway C studies

- OCT is currently funding technologies beneficial to Mars program including atomic clock (DSN scheduling cost efficiencies, navigation accuracy for precision landing) and, inflatable/aerodynamic decelerators (higher altitude landing site access, mass to the surface, and ultra-precision landing), and should continue

- Other high priority technologies to be considered by OCT include optical communications, advanced SEP capabilities, and small sat/cubesats for deep space applications.

Cross Technology Opportunities

Mars Program Re-Planning 2012

Early Missions

- Precision landing (single-km diameter landing footprint 3σ), higher altitude landing sites, and increased payload to surface
  - Inflatable decelerators, smart parachutes, guided entry,
- Reduced DSN tracking time and enhanced data return
  - atomic clock
- Mars Ascent Vehicle (MAV)
- Communications
  - Optical comm, DSN/DTE link, next generation UHF

Mid to Late Missions

- Pinpoint landing and hazard avoidance (i.e., 100m diameter)
- In situ resource utilization (ISRU) at relevant scales
- ISRU enabled MAV
- Dust effects, mitigation and toxicity
- Higher performance solar electric propulsion, nuclear thermal propulsion, fission power systems
- Supersonic Retro-Propulsion (SRP)

Mars Forum - Experiment in Public Engagement

Mars Program Re-Planning 2012

- **Purpose:** Engage the public in a conversation about Mars exploration and the re-planning effort. Find out what the public wants to know, so that we can provide relevant responses.

- **Method:** Ideascale tool – allows public to pose questions, respond to questions, and "vote" on the user-generated content.
  http://mars.ideascale.com

- **Phase 1 Completed:** June 8 – July 1

- **Most popular topics:**
  - Permanent settlement / Colonization
  - Partnering with private industry
  - (Building a) Public support campaign
  - Reducing travel time to Mars
  - Race for Mars (with other countries)
  - Terraforming Mars

Performance Through July 1, 2012	Total
Registered Users	1261
Total Questions Submitted	586
Total Votes	8775
Total Comments	2792

Summary

Mars Program Re-Planning 2012

- MPPG products are setting the stage for continued collaboration between science, human exploration, and technology, towards the common objective of Mars Exploration
- Sample return provides a common frame of reference for advancing knowledge, technology and capability. MPPG is exploring multiple architecture and implementation options, while also exploring alternative questions.
- LPI and inputs from the general public continue to reinforce the persistent interest in Mars Exploration